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North Carolina Department of Transportation
Planning and Research Branch
Thoroughfare Planning

Manteo Thoroughfare Plan

June, 1987

Manteo Thoroughfare Plan

Prepared by:

Thoroughfare Planning Unit
Planning and Research Branch
Division of Highways
North Carolina Department of Transportation

In cooperation with:

The Town of Manteo and
The Federal Highway Administration

June, 1987

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I. INTRODUCTION

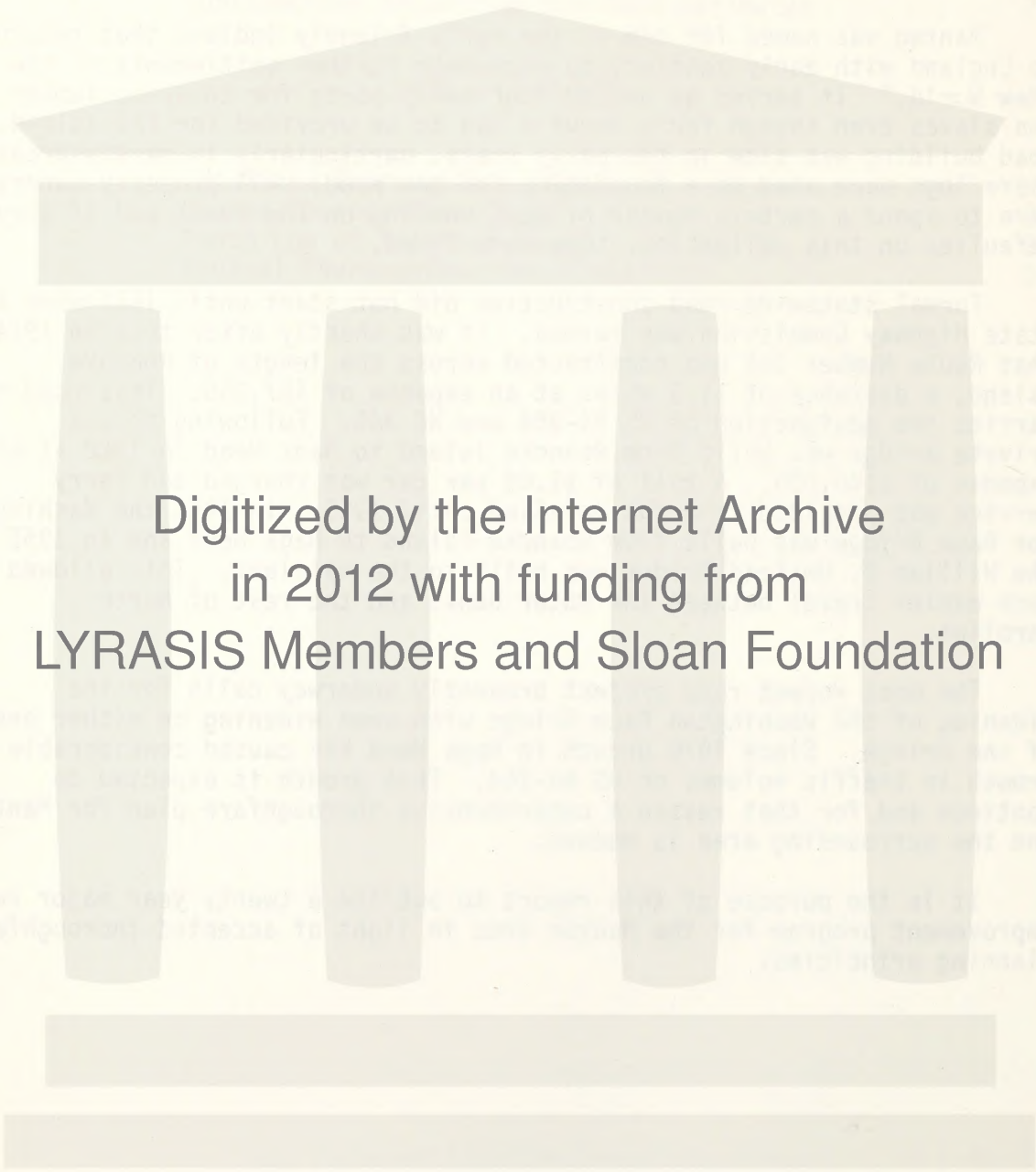
The town of Manteo is located on Roanoke Island in historic Dare County. Its origins go back over 400 years to the arrival of the first English colonies.

Manteo was named for one of the early friendly Indians that returned to England with early settlers to encourage further settlements in the "New World." It served as one of four early ports for tobacco, lumber and slaves even though ferry service had to be provided for the island. Road building was slow in the early years, particularly in marshy areas where logs were used as a foundation for the road. All property owners were to spend a certain number of days working on the roads and if they defaulted on this obligation, they were fined.

Formal statewide road construction did not start until 1921 when the State Highway Commission was formed. It was shortly after this in 1924 that Route Number 345 was constructed across the length of Roanoke Island, a distance of 11.6 miles at an expense of $87,266. This road now carries the designation of US 64-264 and NC 345. Following this a private bridge was built from Roanoke Island to Nags Head in 1928 at an expense of $140,000. A toll of $1.00 per car was charged and ferry service was provided from the mainland until 1955. In 1951 the Washington Baum Bridge was built from Roanoke Island to Nags Head and in 1955 the William B. Umstead Bridge was built to the mainland. This allowed much easier travel between the Outer Banks and the rest of North Carolina.

The most recent road project presently underway calls for the widening of the Washington Baum Bridge with some widening on either end of the bridge. Since 1970 growth in Nags Head has caused considerable growth in traffic volumes on US 64-264. This growth is expected to continue and for that reason a comprehensive thoroughfare plan for Manteo and the surrounding area is needed.

It is the purpose of this report to outline a twenty year major road improvement program for the Manteo area in light of accepted thoroughfare planning principles.



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II. THOROUGHFARE PLANNING PRINCIPLES

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with changing traffic demands. Through proper planning for street development, many costly errors and much needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

(1) To provide for the orderly development of an adequate major street system as land development occurs;

(2) To reduce travel and transportation costs;

(3) To reduce the cost of major street improvements to the public through the coordination of the street system with private action;

(4) To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;

(5) To minimize disruption and displacement of people and businesses through long range advance planning for major street improvements;

(6) To reduce environmental impacts such as air pollution, resulting from transportation;

(7) To increase travel safety.

Thoroughfare planning objectives are achieved through both: (1) improving the operational efficiency of thoroughfares; and (2) improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined as the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic and weather.

Physical ways to improve vehicular capacity include Street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four travel lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. Impedances to traffic flow caused by slow moving or turning vehicles and adverse effects of horizontal and vertical alignments are thus reduced.

Operational ways to improve street capacity include:

(1) Control of access - A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

(2) Parking removal - Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

(3) One-way operation - The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

(4) Reversible lanes - Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

(5) Signal phasing and coordination - Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

(1) Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

(2) Encourage the use of transit and the bicycle mode.

(3) Encourage industries business, and institutions to stagger work hours or establish variable work hours for employees. This will reduce travel demand in peak periods and spread peak travel over a longer time period.

(4) Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions--traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property lead to intolerable traffic flow friction and congestion.

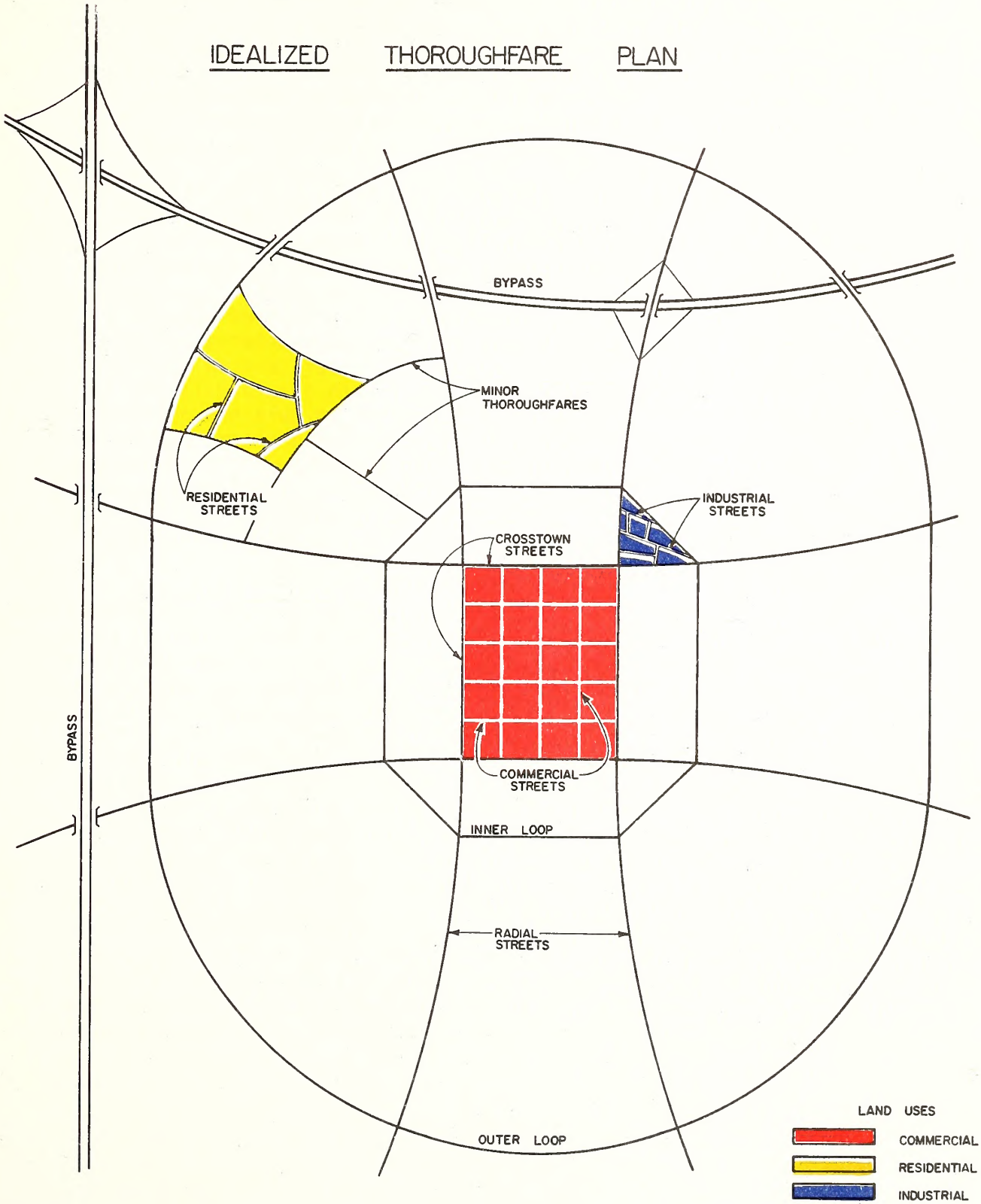
The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, or major thoroughfares (see Figure 1).

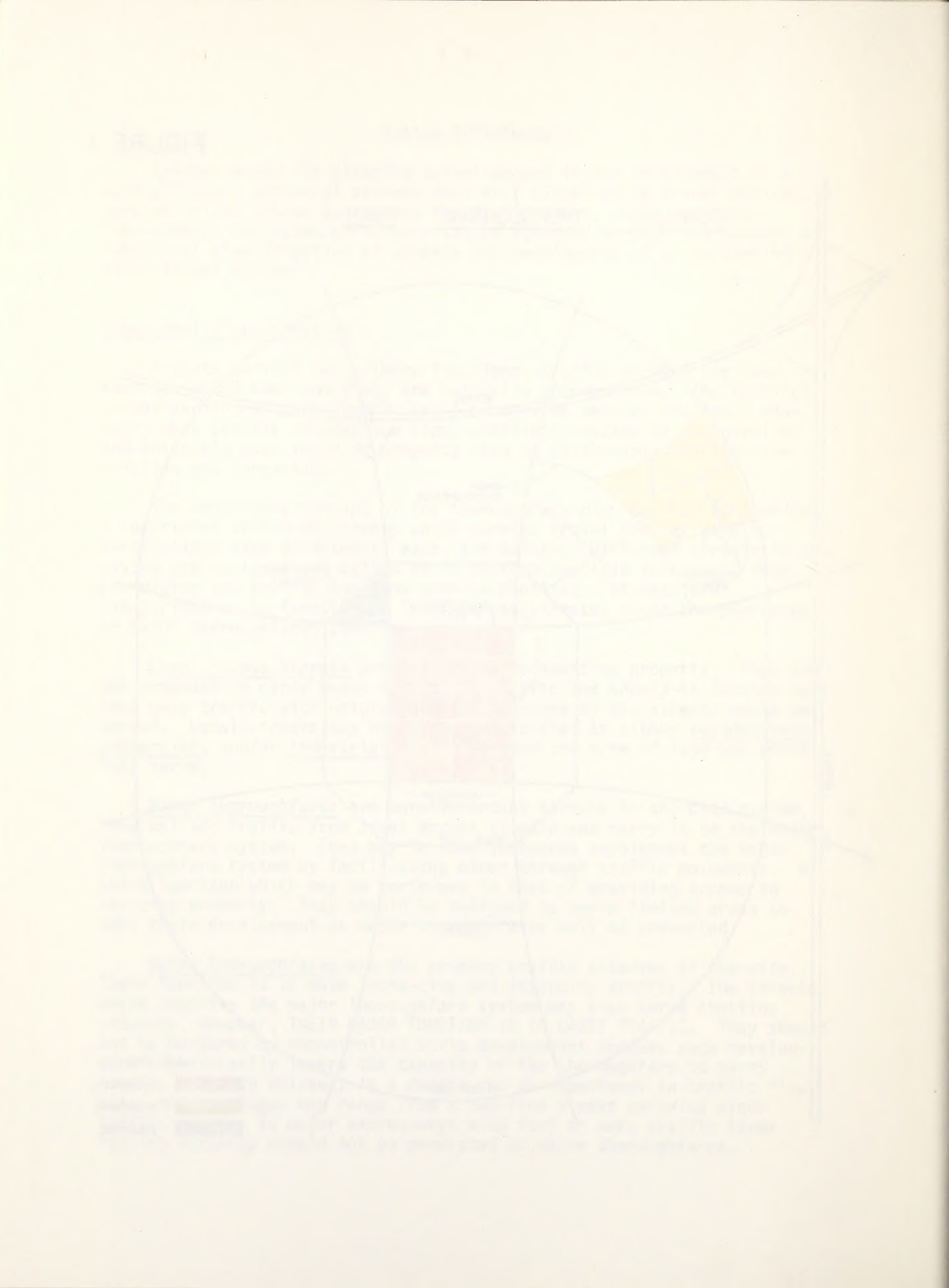
Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations on the streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use which they serve.

Minor Thoroughfares are more important streets in the city system. They collect traffic from local access streets and carry it to the major thoroughfare system. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function which may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and intercity traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, THEIR MAJOR FUNCTION IS TO CARRY TRAFFIC. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

FIGURE 1


IDEALIZED THOROUGHFARE PLAN
BYPASS
MINOR THOROUGHFARES
RESIDENTIAL STREETS
INDUSTRIAL STREETS
CROSSTOWN STREETS
COMMERCIAL STREETS
INNER LOOP
RADIAL STREETS
OUTER LOOP
BYPASS
LAND USES
COMMERCIAL
RESIDENTIAL
INDUSTRIAL



Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area and which permits movement between various areas of the city with maximum directness is the radial-loop system. This system consists of several functional elements-radial streets, crosstown streets, loop system streets, and bypasses (Figure 1).

Radial streets provide for traffic movement between points located in the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets which form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other to follow the area's border and allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area, and they are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing from it traffic which has no desire to be in the city. Bypasses are usually designed to through highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

III. EXISTING CONDITIONS

Major Routes

Manteo is served primarily by US 64-264 which provides access to the mainland and to the Outer Banks. The only other major road on Roanoke Island is NC 345 which leads to Wanchese and carries no through traffic. US 64-264 is a two and three lane road with considerable strip development. Right of way on some sections is only 60 feet and the close proximity of development makes widening expensive and disruptive.

Population Trends

Travel is directly related to population although in Manteo a large percent of the travel originates outside the immediate area. Population trends and projections for Manteo, Nags Head Township and Dare County are shown in Table 1 below :

Table 1

Population Trends and Projections

Year	1940	1950	1960	1970	1980	2005
Dare County	6041	5405	5935	6995	13377	26000
Nags Head Township	2547	2422	2760	3328	4971	9200
Manteo	571	635	587	547	902	1800

As shown in Table 1, growth between 1970 and 1980 was much faster than previous decades. Population projections assumed a continuation of recent trends which resulted in the population nearly doubling between 1980 and 2005. Most of the population growth is expected to the west and northwest of the existing town limits. Marshy terrain southwest and southeast of Manteo restrict growth in that direction. Some residential development in the form of condominiums has occurred along Queen Elizabeth Avenue recently and this will probably continue over the next five to ten years. Most of the rest of the central business district is relatively stable.

Economy and Employment

Manteo's primary industry is tourism which increases average daily traffic by 60% during summer months. Manteo is probably most famous for its attractions that relate to the Lost Colony. This includes Fort Raleigh National Historic Site and The Elizabeth II Visitors Center. Other points of interest on Roanoke Island include the North Carolina Marine Resources Center and the Christmas Shop. A variety of commercial businesses along US 64-264 contribute substantially to the economy and

retail furniture sale is a major business in the central business district.

Other major employers in the area include Dare County Regional Airport, Dare County, Manteo Elementary School, Manteo Middle School and Manteo High School.

Analysis of Traffic Accidents

Accident records for January 1984 through December 1986 were studied as part of the thoroughfare plan development. Listed below are the major accident locations with their corresponding number of accidents.

Table 2

High Accident Locations, Manteo, N. C.
January 1984 - December 1986

	number of accidents
US 64 at NC 345	11
US 64 at Fernando	10
US 64 at Sir Walter Raleigh	10
US 64 at Agona	7
US 64 at Budleigh	7
US 64 at SR 1132	6
US 64 at SR 1117	5
Total	56

As shown in Table 2, all the accidents occurred on US 64 and were often caused by turning traffic and roadside development. Thirty percent of the accidents occurred on weekends which correlates with the higher traffic volumes during that time. Reductions in driveways and further restrictions on future development would help to reduce accident potential.

Construction of a US 64-264 Bypass would also help to reduce accident potential along existing US 64-264 by reducing congestion and by separating faster through travel from slower local travel.

Analysis of Travel

Travel in Manteo can be separated into three general types based on origin and destination.

The first type is through travel which is not interested in stopping in Manteo, but usually interested in either going home or going to the beach. The typical through traveler hates congestion and traffic signals and will usually drive on a bypass when given the opportunity.

The second type of travel is external-internal travel. This is travel with one terminus in the Manteo area. This includes travel with an ultimate distant destination that stops to eat or to visit some other attraction. Much of the external-internal traffic for Manteo comes from the Nags Head area. Traffic counts indicate that three times as much external-internal traffic comes from Nag Head as from areas west of Manteo. These counts support the need for a US 64-264 Bypass which will segregate through traffic from external-internal travel and tie in nicely with widening on US 64-264 east of NC 345. Decreasing congestion on US 64-264 will also promote tourism in that area by making it easier to access points of interest in Manteo.

The third type of travel is local travel. These trips would begin and end in and around Manteo. This could be a trip by a permanent resident from his home to the grocery store or a trip by tourist from a restaurant to the Elizabeth II Visitor Center for example. People who make these trips are less concerned about time than the through traveler.

Due to the fact that US 64-264 is the only road that traverses the study area, it must accommodate through, external-internal and local travel. These three types of travel are somewhat incompatable and should be segregated as much as possible. The Thoroughfare Plan addresses this concern within the socio-economic constraints of the area.

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IV. RECOMMENDATIONS

The following is a list of roads that are recommended to serve as major and minor thoroughfares as discussed in Chapter II. A brief discussion of the road's deficiencies and function is included to support its classification as a thoroughfare. More detail on physical and operational characteristics is given in Appendix A Table 1.

Major Thoroughfares

Airport Road (SR 1116 & 1115) provides access to the Dare County Regional Airport and the North Carolina Marine Resources Center It is a narrow eighteen foot pavement that needs widening to a standard twenty two foot cross section. A connector to US 64-264 is proposed to make access from the west more direct and to ease future congestion.

Ananias Dare Street (SR 1190) serves as a major facility for downtown Manteo and the Elizabeth II Visitor Center. No major future improvements are recommended and one way operation is expected to continue.

Budleigh Street (SR 1150) is the widest street leading from US 64-264 to Queen Elizabeth Avenue. Because of its width two way operation with parking should continue to function satisfactorily.

NC 345 is the only NC route in the study area and carries traffic between Wanchese and US 64-264. Traffic volumes do not justify major widening.

SR 1128 will carry traffic between US 64-264 and the proposed US 64-264 Bypass. It is presently an eighteen foot pavement and should be widened to a standard twenty-two feet.

US 64-264 serves as the major traffic carrier for local and non-local travel. Because of the strip development through much of Manteo it must handle a high percentage of turning traffic which detracts from the capacity of the road and increases accident potential. Fortunately some of the road has a center turn lane which keeps the two outside lanes open to travel most of the time. Widening from NC 345 east is already scheduled for 1988 in the North Carolina Transportation Improvement Program, 1987-1995. If the proposed US 64-264 Bypass is built no other major improvements of US 64-264 should be necessary. Traffic volumes west of Manteo are considerably less than east of Manteo and widening should not be needed for this reason. Widening existing US 64-264 to 5 lanes would handle expected traffic over the next twenty years, however ten businesses and eleven homes between Manteo Middle School and Harriott Street would be displaced by the widening of an estimated cost of $3,300,000. The total cost of widening would be $2,800,000 more than a bypass. For these reasons a bypass was selected over widening.

US 64-264 Bypass is recommended to separate travel by function and to avoid the expensive and disruption of widening US 64-264. A two lane road on 110 feet of right of way is proposed to allow for an ultimate four lane divided cross section (see Appendix A Table 1). A benefits analysis was performed to see if driver savings justified construction of this project and a net benefit per mile of $18,600,000 resulted during a twenty year design period.

Walter Raleigh Street (SR 1189) complements Budleigh Street and serves downtown travel. Pavement width on this street is adequate and no major improvements are necessary.

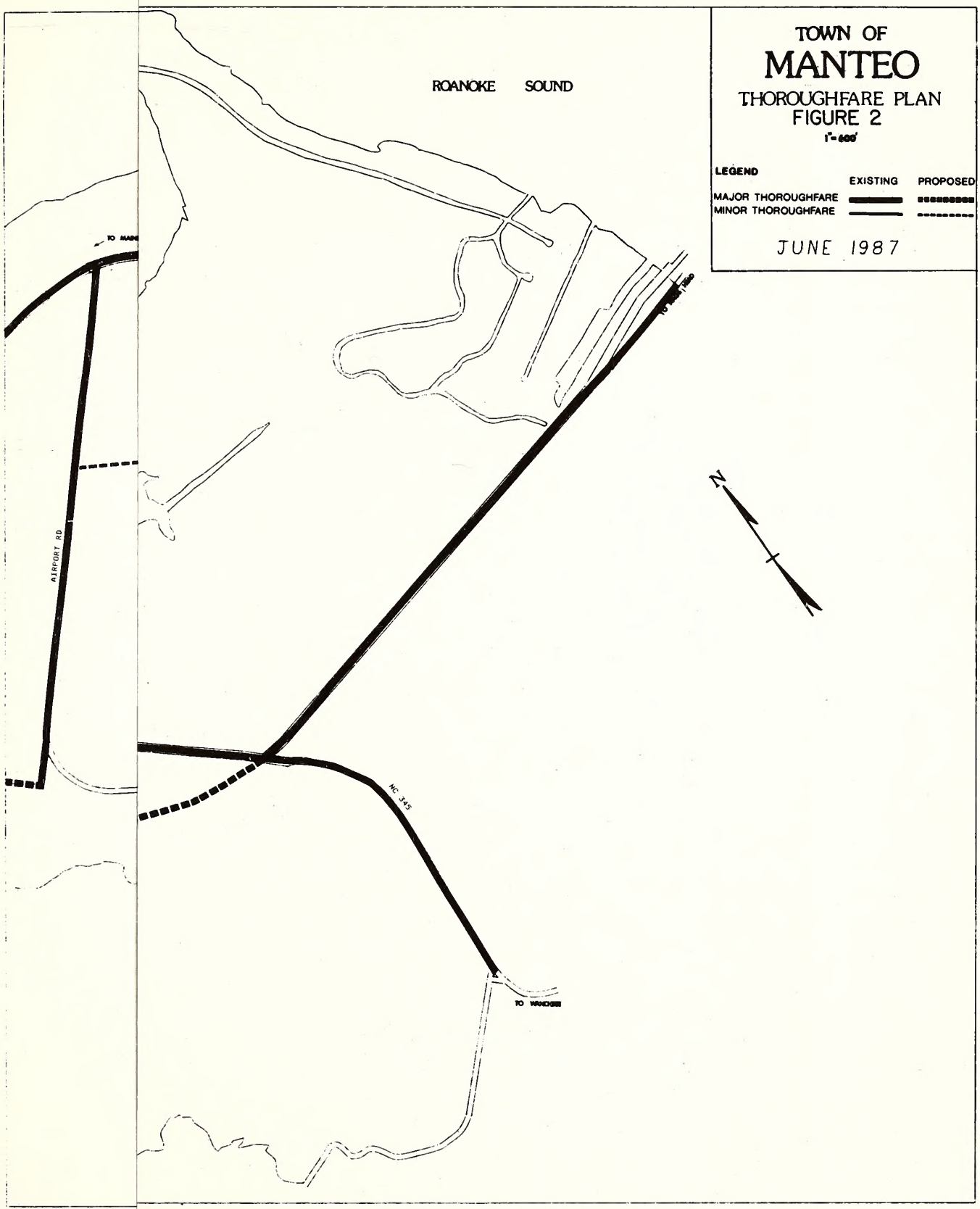
Minor Thoroughfares

Bauser Town Road - California Avenue (SR 1129) serves local residential travel west of US 64-264 and keeps this traffic off of US 64-264. The existing eighteen foot pavement is recommended for widening to twenty-two feet and should be extended at SR 1128 to Burnside Road to correct the offset intersection at that location.

Burnside Road (SR 1123) will tie in with Bauser Town Road to carry local travel west of US 64-264. An extension to Harriot Street is proposed and widening to twenty-two feet is recommended.

Harriot Street (SR 1118) is recommended for widening to twenty-two feet with an extension to Airport Road. This will facilitate local travel between The Dare County Regional Airport, The North Carolina Marine Resource Center and US 64-264 Bypass in an efficient manner and will decrease turning traffic on US 64-264.

Virginia Street (SR 1121) serves travel between areas northeast of Manteo and downtown Manteo. Widening to twenty-two foot travel lanes with parking and curb and gutter is recommended for safety reasons. With a connector over to US 64-264, some of the school traffic for Manteo High School and Manteo Elementary can be diverted away from US 64-264.


TOWN OF
MANTEO
THOROUGHFARE PLAN
FIGURE 2
1"=600'
LEGEND
EXISTING
PROPOSED
MAJOR THOROUGHFARE
MINOR THOROUGHFARE
JUNE 1987
ROANOKE SOUND
TO MANTEO
AIRPORT RD
NC 345
TO WANCHESE
N

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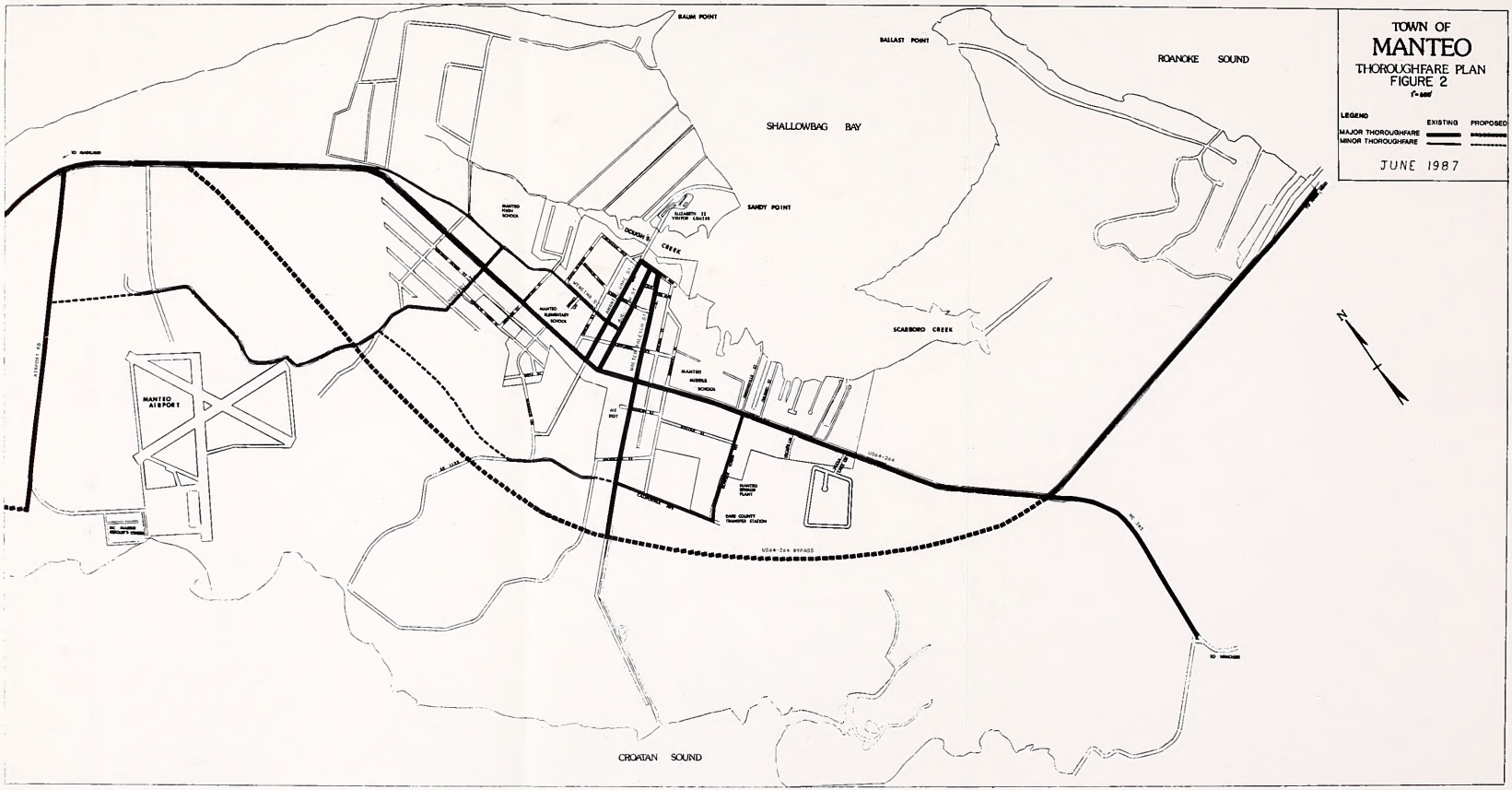

TOWN OF
MANTEO
THOROUGHFARE PLAN
FIGURE 2
1"= 600'
LEGEND
EXISTING
PROPOSED
MAJOR THOROUGHFARE
MINOR THOROUGHFARE
JUNE 1987
BAUM POINT
BALLAST POINT
ROANOKE SOUND
SHALLOWBAG BAY
SANDY POINT
ELIZABETH II VISITOR CENTER
DUNCAN'S CREEK
SCARBORO CREEK
MANTEO AIRPORT
MANTEO HIGH SCHOOL
MANTEO ELEMENTARY SCHOOL
MANTEO MIDDLE SCHOOL
MANTEO SEWAGE PLANT
DARE COUNTY TRANSFER STATION
US64-264 BYPASS
CROATAN SOUND
N

Construction Priorities and Cost Estimates

Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic carries would be more important than minor thoroughfares where traffic volumes are lower. To be in the States Transportation Improvement Program a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. Based on these considerations the priorities shown in Table 3 were recommended.

Table 3
Construction Priorities and Cost Estimates

Project	Recommended Cross Section (see Figure 4) (ultimate)	Construction Cost	Right of Way Cost	Total Cost
First Priority				
US 64 - 264 Bypass	L (B)	$2,775,000	$600,000	$3,375,000
Airport Road Connector	L	462,000	50,000	512,000
Second Priority				
Burnside Road Extension	L	385,000	40,000	425,000
Harriot Street Extension	L	154,000	20,000	174,000
Airport Road Widening	L	450,000	0	450,000
Third Priority				
Bowser Town Road Widening	L	100,000	0	100,000
Burnside Road Widening	L	290,000	0	290,000
California Avenue Widening	L	129,000	0	129,000
Harriot Street Widening	L	547,000	0	547,000
SR 1128 Widening	L	160,000	0	160,000
Wingina Street Widening	J	290,000	10,000	300,000
		$5,742,000	$720,000	$6,462,000

PHOTO LOG OF SELECTED NEEDS

US 64 WEST OF MANTEO

US 64 IN MANTEO

US 64 EAST OF MANTEO

ANANIAS DARE STREET

BUDLEIGH STREET

SIR WALTER RALEIGH STREET

US 64-264 BYPASS AT SIR WALTER RALEIGH STREET

CALIFORNIA AVE. EXTENSION

US 64-NC 345 INTERSECTION

PROPOSED US 64 BUSINESS AND US 64 BYPASS INTERSECTION

DRIFTWOOD DRIVE AT ETHRIDGE ROAD

WINGINA STREET NEAR MANTEO HIGH SCHOOL

The total cost for needed major road improvements for Manteo and vicinity over the next twenty years is $6,687,000. The US 64-264 Bypass stands out as the most expensive project, however it will also stand out in benefits provided. Other projects in the first priority category aimed at completing the major thoroughfare system. This will give the system more continuity and efficiency. The second priority focused on completing the minor thoroughfare system to make local travel more efficient. The third priority recommends that all roads on the thoroughfare system be brought up to standard to increase traffic safety. Not included on this list are improvements to the Roanoke Sound Bridge and widening on US 64-264 east of NC 345. Because this project is already programmed, no priority needed to be set. The estimated cost of this project is $24,150,000.

V. IMPLEMENTATION

State-Municipal Adoption of the Thoroughfare Plan

Both the Town of Manteo and the North Carolina Department of Transportation have responsibility for implementation of the Manteo Thoroughfare Plan. Chapter 136, Article 3A, Section 136-66.2 of the North Carolina General Statutes provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Board of Transportation as the basis for future street and highway improvements. After mutual adoption, negotiations will begin to determine which of the existing and proposed thoroughfares will be a Department of Transportation responsibility and which will be a municipal responsibility. Facilities which are designated as State responsibility will be constructed and maintained by the Division of Highways; however, the municipality will share in the right-of-way costs. This share of costs will be determined at the time of construction.

In general, the State is responsible for those facilities which will be serving major volumes of through traffic and traffic from outside the area to major commercial, industrial, and institutional areas inside the municipality. Those facilities which will serve primarily internal traffic are to be a municipal responsibility.

After adoption of the thoroughfare plan, a municipality has the legal authority provided by the General Statutes of North Carolina to protect existing and proposed highway corridors through subdivision regulations and future street-line ordinances. On highway projects that are designated as State responsibility, the municipality's share of the right-of-way cost is partially determined by the extent that the municipality has protected the proposed corridor. This has long-range implications to a municipality's budget because right-of-way costs on unprotected corridors often greatly exceed construction costs.

Capital Improvement Program

A capital improvement program makes it easier to build a planned thoroughfare system. This capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated a municipal responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as State responsibility to be submitted to the Department of Transportation as recommendations for inclusion in the "North Carolina Improvement Program."

The priority groupings in this report should provide a basis on which the town of Manteo can develop their capital improvement program. Some examples of the potential effectiveness of this program follow:

Widening Wingina Street
Widening Bowser Town Road
Widening Burnside Road

Subdivision Controls

Since many of the proposed thoroughfares are outside the existing Manteo Corporate Limits, it is recommended that additional building setbacks on right-of-way reservation conforming to the Thoroughfare Plan also be applied in the extraterritorial jurisdiction area. This will allow for orderly implementation of the plan in Manteo's fringe areas without disruption to adjoining land owners.

Streets which may be partially built, wholly built, or improved through the use of the subdivision ordinance are:

Harriot Street Extension
Burnside Road Extension
Airport Road Extension

Official Street Map

A municipality may, through special enabling legislation, adopt an official street map which indicates both existing and future street lines. Under this legislation, no new construction or reconstruction of structures would be permitted within the designated future street lines. Over a period of time, this would reduce the cost of additional right-of-way along densely developed thoroughfares which will require widening at some future date.

Facilities in Manteo which could benefit from an official street map with specified setback distances are:

US 64-264
Airport Road

Zoning

The zoning ordinance is an important tool in that it will regulate future land development and minimize undesirable development along roads and highways. The zoning ordinance can improve highway safety by requiring sufficient building setbacks to provide for adequate sight distances and by requiring off-street parking. A good zoning ordinance also minimizes strip commercial development which creates traffic friction and increases the traffic accident potential.

Streets within the planning area that are either experiencing strip development pressures, or that are expected to in the future include:

US 64-264
US 64-264 Bypass

APPENDIX A TABLE1

THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY & SECTION	EXISTING X - SECTION DIST MI	RDWY FT	ROW FT	CAPACITY CURRENT (FUTURE)	(1) 1986 ADTS	(1) 2005 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
AIRPORT RD (SR1116 & 1115)								
US 64-264 TO DEAD END	1.4	18	60	6000	500	2000	L	NC
DEAD END TO SR1161	0.6	-	-	-	-	-	L	60
ANANIAS DARE ST. (SR1190)								
US64-264 TO SR1191	0.4	28	60	8000	2600	4000	NC	NC
SR1191 TO ELIZ.II PARK	0.1	24	60	10000	-	-	NC	NC
BOWSER TOWN ROAD (SR1129)								
US 64-264 TO CALIFORNIA	0.3	18	60	5000	200	500	L	NC
BUDLEIGH ST (SR1150)								
US64-264 TO QUEEN ELIZ.	0.4	34	60	11000	3200	7000	NC	NC
BURNSIDE ROAD (SR1123)								
US64-264 TO SR1127	0.4	16	60	5000	1500	3000	L	NC
SR1127 TO PROPOSED EXT.	0.1	20	60	8000	600	1500	NC	NC
PROPOSED EXT TO SR1118	0.5	-	-	-	-	1500	L	60
CALIFORNIA AVE. (SR1129)								
BOWSER TOWN TO SR1128	0.4	18	60	5000	200	500	L	60
SR1128 TO BURNSIDE RD.	0.1	-	-	-	-	500	L	60
HARRIOT ST. (SR1118)								
SR1121 TO US64-264	0.1	24	60	10000	1800	4000	NC	NC
US64-264 TO SR1117	1.3	18	60	6000	1000	2000	L	NC
SR1117 TO DEAD END	0.2	12	60	2000	400	2000	L	NC
DEAD END TO SR1116	0.2	-	-	-	-	2000	L	60
NC 345								
US64-264 TO SR1134	0.7	22	60	5000	3500	5000	NC	NC
SR1128								
US64-264 TO US64 BYPASS	0.5	18	60	5000	1500	3000	L	NC
US64-264								
NW POINT TO US64 BYPASS	2.3	22	100	10000	3500	10000	NC	NC
US64-264 TO SR1118	1.2	22	100	10000	9000	10000	NC	NC
SR1118 TO SR1131	0.7	44	60	12000	10000	10000	NC	NC
SR1131 TO NC345	1.3	44	100	12000	12000	10000	NC	NC
NC345 TO ROANOKE	1.3	24	60	10000	9500	20000	H	70
US64-264 BYPASS								
US64-264 TO SR1128	2.0	-	-	(12000)	-	10000	L(B)	110
SR1128 TO NC345	1.6	-	-	(12000)	-	12000	L(B)	110
WALTER RALEIGH ST.(SR1189)								
SR1191 TO US64-264	0.4	25	60	10000	600	1200	NC	NC
WINGINA ST (SR1121)								
US64 TO BORDEN ST	0.5	16	60	5000	500	1000	J	70
BORDEN ST TO SR1195	0.2	18	60	6000	500	1000	J	70
SR1195 TO SR1190	0.1	16	60	5000	500	1000	J	70
SR1190 TO SR1150	0.1	18	60	6000	500	1000	J	70

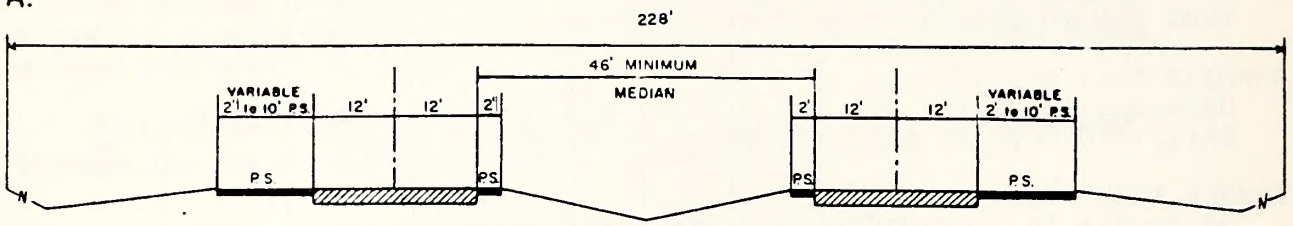
(1) FACTOR ADT'S BY 1.57 TO CONVERT TO SUMMER PEAK VOLUMES

NC-NO CHANGE

FIGURE 4

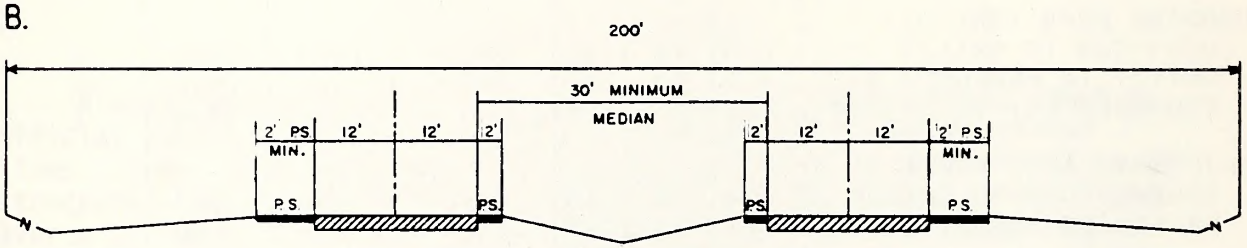
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



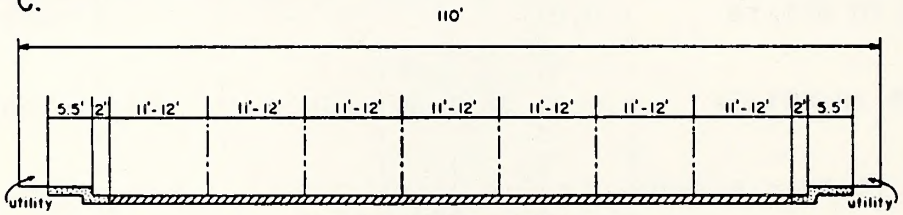
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



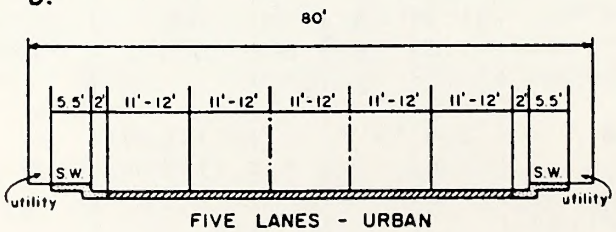
FOUR LANES DIVIDED WITH MEDIAN - RURAL

C.



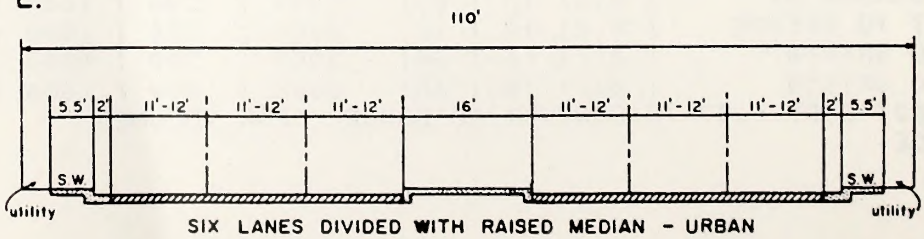
SEVEN LANES - URBAN

D.



FIVE LANES - URBAN

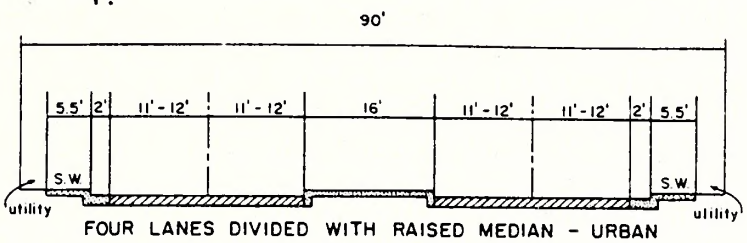
E.



SIX LANES DIVIDED WITH RAISED MEDIAN - URBAN

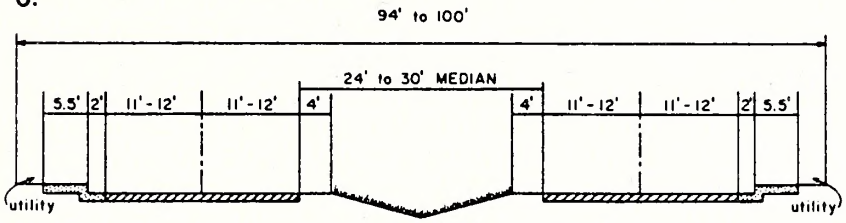
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



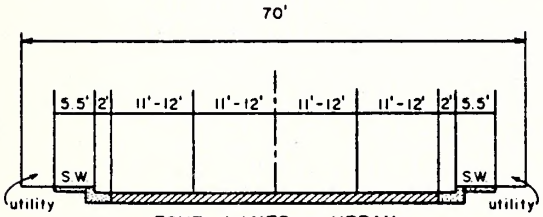
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



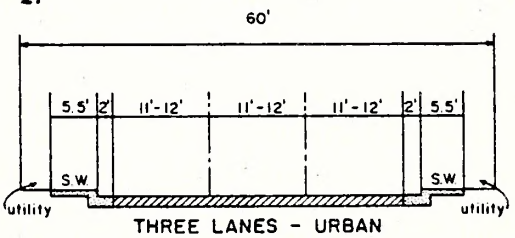
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



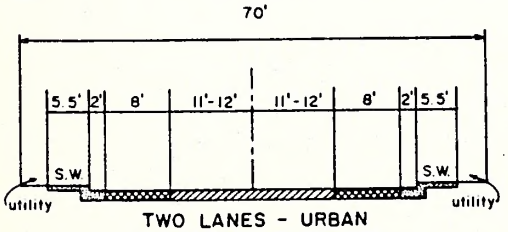
FOUR LANES - URBAN

I.



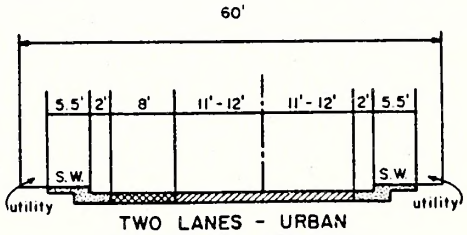
THREE LANES - URBAN

J.



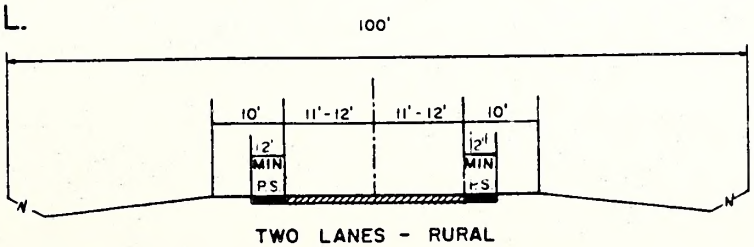
TWO LANES - URBAN
PARKING ON EACH SIDE

K.



TWO LANES - URBAN
PARKING ON ONE SIDE

L.



TWO LANES - RURAL

APPENDIX B

Typical Thoroughfare Cross Sections Explanations

Design requirements for thoroughfares vary according to the desired capacity and level of services to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its design requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Typical cross section requirements are shown in Figure 3. Cross Section "A" is typical for controlled access freeways. The 46 foot grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Slopes of Right-of-way requirements would typically vary depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, and cross section "D", five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "1". Cross section "J" and "K" are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

Cross section "L" is used in rural areas or for staged construction of a wider multilane cross section. On some thoroughfares projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time.

The curb and gutter urban cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

Right-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare planning.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service and available right-of-way. The recommended typical cross sections for the King thoroughfares are given in Appendix A along with other pertinent information.

APPENDIX C

RECOMMENDED DEFINITIONS AND DESIGN STANDARDS FOR SUBDIVISION ORDINANCES

DEFINITIONS:

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a network of continuous routes serving corridor movements having trip length and travel density characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural link in a network joining cities and larger towns and providing intrastate and intercounty service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intracounty travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to small local communities and links the locally important traffic generators with their rural hinterland.

5. Local Road - A local road that serves primarily to provide access to adjacent land and for travel over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway links, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares are important streets in the city. system and perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating a minor through-traffic movement and may also serve abutting property.

3. Local Street - A local street is any link not on a higher-order urban system and serves primarily to provide direct access to abutting land and access to higher systems.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway' - Divided multilane roadways designed to carry large volumes of traffic at relatively high speeds. A freeway is a divided highway providing for continuous flow of vehicles with no direct access to abutting property or streets and with access to selected crossroads provided via connecting ramps. An expressway is a divided highway with full or partial control of access and generally with grade separations at major intersections. A parkway is a highway for non-commercial traffic, with full or partial control of access, and usually located within a park or a ribbon of parklike development.

2. Residential Collector Street - A local access street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having but one end open to traffic and the other end being permanently terminated and a vehicular turnaround provided.

5. Frontage Road - A local street or road that is parallel to a full or partial access controlled facility and functions to provide access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

1. Corner Lot - A lot abutting upon two streets at their intersection.

2. Double-Frontage Lot - A continuous (through) lot which is accessible from both of the parallel streets upon which it fronts.

3. Reverse-Frontage Lot - A continuous (through) lot which is accessible from only one of the parallel streets upon which it fronts.

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, whether immediate or future, of sale or building development, and all divisions of land involving the dedication of a new street or a change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or recombination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved, (3) the public acquisition by purchase of strips of land for the widening or opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. Since a transfer of property is involved, the dedication is made by written instrument and is completed with an acceptance.

D. Reservation - A reservation of land does not involve any transfer of property rights. It simply constitutes an obligation to keep property free from development for a stated period of time.

Design Standards

I. Streets and Roads:

The design of all streets and roads within _____ shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHO) manuals.

The provision of street rights-of-way shall conform and meet the requirements of the thoroughfare plan for _____ as adopted by the _____ and the North Carolina Department of Transportation.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

The urban planning area shall consist of that area within the urban planning boundary as depicted on the mutually adopted _____ Thoroughfare Plan. The rural planning area shall be that area outside the urban planning boundary.

A. Right-of-Way Widths: Right-of-way widths shall not be less than the following and shall apply except in those cases where right-of-way requirements have been specifically set out in the Thoroughfare Plan.

		Min. Right of Way, Ft.
1.	Rural	
a.	Principal Arterial	
	Freeways	350
	Other	200
b.	Minor Arterial	100
c.	Major Collector	100
d.	Minor Collector	100
e.	Local Road	*60

*The desirable minimum right-of-way is 60 feet. If curb and gutter is provided, 50 feet of right-of-way is adequate on local residential streets.

Min. Right of Way, Ft.

2. Urban

a.	Major Thoroughfare Other than Freeway and Expressway	90
b.	Minor Thoroughfare	70
c.	Local Street	*60
d.	Cul-de-sac	**Variable

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for an access controlled facility, the subdivider will only be required to make a reservation.

A partial width right-of-way, not less than sixty (60) feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

---

*The desirable minimum right-of-way is established as 60 feet. If curb and gutter is provided, 50 feet of right-of-way is adequate.

**The right-of-way dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to right-of-way should not be less than distance from edge of pavement to right-of-way on street approaching turnaround.

B. Street Widths: Widths for street and road classifications other than local shall be as required by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and gutter section 26 feet, to face of curb
   Shoulder section - 20 feet to edge of pavement,
   4 foot shoulders

Min. Right of Way, Ft.

2. Urban

a.	Major Thoroughfare Other than Freeway and Expressway	90
b.	Minor Thoroughfare	70
c.	Local Street	*60
d.	Cul-de-sac	**Variable

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for an access controlled facility, the subdivider will only be required to make a reservation.

A partial width right-of-way, not less than sixty (60) feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths: Widths for street and road classifications other than local shall be as required by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and gutter section 26 feet, to face of curb
   Shoulder section - 20 feet to edge of pavement, 4 foot shoulders

---

*The desirable minimum right-of-way is established as 60 feet. If curb and gutter is provided, 50 feet of right-of-way is adequate.

**The right-of-way dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to right-of-way should not be less than distance from edge of pavement to right-of-way on street approaching turnaround.

2. Residential Collector
   Curb and gutter section 34 feet, face to face of curb
   Shoulder Section 20 feet to edge of pavement, 6 foot shoulders

C. Geometric Characteristics: The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed

The design speeds for subdivision type streets shall be:

	Desirable	(Minimum)		
		Level	Rolling	Mountainous
Rural				
Minor Collector Roads	60	(50)	(40)	(30)
Local Roads including Residential Collectors and Local Residential	50	(50)*	(40)*	(30)*
Urban				
Major Thoroughfares Other than Freeway or Expressway	60	(50)	(50)	(50)
Minor Thoroughfares	60	(50)	(40)	(40)
Local Streets	40	(40)**	(30)**	(20)**

*Based on projected annual average daily traffic of 400-750. In cases where road will serve a very limited area and small number of dwelling units, minimum design speeds can be reduced further.

**Based on projected annual average daily traffic of 50-250.

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

Design Speed	Level	Rolling	Mountainous
60	3	4	6
50	4	5	7
40	5	6	8
30		9	10
20			12

b. A minimum grade for curbed streets normally should not be less than 0.5%, a grade of 0.35% may be allowed where there is a high type pavement accurately crowned and in areas where special drainage conditions may control.

c. Grades for 100 feet each way from intersections should not exceed 5%.

d. For streets and roads with projected annual average daily traffic less than 250, short grades less than 500 feet long, may be 150% greater.

3. Minimum Sight Distances

In the interest of public safety, no less than the minimum sight distance applicable shall be provided in every instance. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters. (General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case):

Design Speed, MPH	20	30	40	50	60
Stopping Sight Distance					
Min. Distance, Ft.	150	200	275	350	475
Des. Distance, Ft.	150	200	300	450	650
Min. K* Value For:					
Min. Crest Curve	16	28	55	85	160
Des. Crest Curve	16	28	65	145	300
Min. SAG Curve	24	35	55	75	105
Des. SAG Curve	24	35	60	100	155
Passing Sight Distance					
Min. Passing Distance, Feet (2 lane)		1100	1500	1800	2100
Min. K* Value For Crest Vertical Curve		365	686	985	1340

Sight distance provided for stopped vehicles at intersections should be in accordance with, "A Policy on Geometric Design of Highways and Streets, 1984".

4. The following table shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is .08. The maximum rate of superelevation for urban streets with curb and gutter is .06 with .04 being desirable.

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*K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide minimum sight distance.

Design Speed MPH	Maximum e*	Minimum Radius (Rounded) Feet	Maximum Degree of Curve (Rounded) Degrees
20	.04	125	45.0
30	.04	300	19.0
40	.04	560	10.0
50	.04	925	6.0
60	.04	1410	4.0
20	.06	115	50.0
30	.06	275	21.0
40	.06	510	11.5
50	.06	830	7.0
60	.06	1260	4.5
20	.08	110	53.5
30	.08	250	23.0
40	.08	460	12.5
50	.08	760	7.5
60	.08	1140	5.0

*e = rate of roadway superelevation, foot per foot

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty (60) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided unless exception is granted by the Division of Highways for intersections involving the State Highway System, or the Planning Board for intersections involving only the municipal street system. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs, unless exception is granted by the local planning board, shall not be more than five hundred (500) feet in length. The distance from the edge of pavement on the vehicular turnaround to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access.

   Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least twenty (20) feet.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the deadend as may be approved by the Planning Board.

4. Sharp changes in alignment and grade shall be avoided.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the nearest District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheel Chair Ramps

In accordance with Chapter 136, Article 2A, §136-44.14, all street curbs in North Carolina being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason after September 1, 1973, shall provide wheelchair ramps for the physically handicapped at all intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

Wheelchair ramps and depressed curbs shall be constructed in accordance with details contained in the Department of Transportation, Division of Highways, Publication entitled, "Guidelines, Curb Cuts and Ramps for Handicapped Persons".

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

a. Shoulder Section Approach

i. Under 800 ADT Design Year

Minimum 28 feet width face to face of parapets of rails or pavement width plus 10 feet, whichever is greater.

ii. 800-2000 ADT Design Year

Minimum 34 feet width face to face of parapets or rails or pavement width plus 12 feet, whichever is greater.

iii. Over 2000 ADT Design Year

Minimum 40 feet
Desirable 44 feet width face to face of parapets or rails.

b. Curbs and Gutter Approach

i. Under 800 ADT Design Year

Minimum 24 feet face to face of curbs.

ii. Over 800 ADT Design Year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   a. Shoulder Section Approach - Width of approach pavement plus width of usable shoulders on the approach left and' right.
      Min. 8'
      Des. 10

   b. Curb and Gutter Approach - Width of approach pavement measured face to face of curbs.

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